03-10-00

| UTILITY PATENT APPLICATION TRANSMITTAL UNDER 37 CFR 1.53(b) | ATTORNEY DOCKET 79456MSS |
|---|---|
| Assistant Commissioner for Patents<br>Box Patent Application<br>Washington, D.C. 20231<br><br>CALIBRATION OF COLOR REPRODUCTION APPARATUS<br><br>First Named Inventor (or Application Identifier):<br><br>David J. Statt | **Express Mail Label No.**<br><br>**EL267143117US**<br><br>**Date:** March 9, 2000 |

jc511 U.S. PTO 09/521588 03/09/00

Enclosed are:

1. [X] Specification
2. [2] Sheet(s) of drawing(s)
3. [X] Information Disclosure Statement Under 37 CFR 1.97.
4. Combined Declaration for Patent Application and Power of Attorney:
   4a. [X] New
   4b. [ ] Copy from a prior application (37 CFR 1.63(d) (for continuation/divisional with Box 11 completed)
5. [ ] Incorporation by Reference (useable if Box 4b is checked) The entire disclosure of the prior application, from which a copy of the oath or declaration is supplied under Box 4b, is considered as being part of the disclosure of the accompanying application and is hereby incorporated by reference therein.
6. [X] Assignment of the invention to **Eastman Kodak Company**
7. [ ] Certified copy of a priority document.
8. [ ] Associate Power of Attorney
9. [ ] Deletion of Inventor(s). Signed statement attached deleting inventor(s) named in the prior application, see 37 CFR 1.63(d)(2) and 1.33(b).
10. [ ] If a 111A application prior to examination of the above-identified application, amend the specification at Page 1, after the title, by inserting the following:
    --CROSS REFERENCE TO RELATED APPLICATION
    Reference is made to and priority claimed from U.S. Provisional Application Serial No. , filed , entitled .

**If a CONTINUING APPLICATION,** check appropriate box and supply the requisite information:

11. [ ] Continuation [ ] Divisional [ ] Continuation-in-part (CIP) of prior application No: ,
12. [X] Please address all written communications to Milton S. Sales, Patent Legal Staff, Eastman Kodak Company, 343 State Street, Rochester, NY 14650-2201. Please Direct all telephone calls to Milton S. Sales at (716) 253-0127.

The filing fee has been calculated as shown below:

| FOR: | NO. FILED | | NO. EXTRA | RATE | FEE |
|---|---|---|---|---|---|
| BASIC FEE | | | | | $ 690 |
| TOTAL CLAIMS | 12 | - 20 = | 0 | x 18 = | $ 0 |
| INDEPENDENT CLAIMS | 2 | - 3 = | 0 | x 78 = | $ 0 |
| [ ] MULTIPLE DEPENDENT CLAIM PRESENTED | | | | + 260 | $0 |
| | | | | **TOTAL** | $ 690 |

[X] Please charge my Eastman Kodak Company Deposit Account No. **05-0225** in the amount of $ 690.

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REGULAR ORIGINAL

Application Based on

Docket **79456MSS**
Inventors: David J. Statt

# CALIBRATION OF COLOR REPRODUCTION APPARATUS

Assistant Commissioner for Patents,
ATTN: BOX PATENT APPLICATION
Washington, D. C. 20231

Express Mail Label No.: EL267143117US

Date: March 9, 2000

# CALIBRATION OF COLOR REPRODUCTION APPARATUS

## FIELD OF THE INVENTION

This invention relates to color calibration for digital color reproduction apparatus such as, for example, a color fax or a printer.

## BACKGROUND OF THE INVENTION

Color reproduction apparatus renders an image from color signals representing a color image description. The input to such a color reproduction apparatus is an array of color signals (sets of input code values) communicating the desired colors of a corresponding array of picture elements in the image to be rendered.

The reproduction apparatus causes cyan, magenta and yellow, and sometimes black, dyes to be laid down on a receiving medium in response to color signals (its inherent drive code values) applied to its dye marking or producing devices.

A goal is to make the renderings match an original intent as nearly as possible. In order to do so, a transform is employed which maps the received input code values, normally in RGB space, to the reproduction apparatus' inherent drive code values, so that the system faithfully reproduces the color image original. Often the transform is implemented by employing a set of three or four one-dimensional calibration lookup tables. The process of deriving such a transform is called system color calibration.

Such apparatus requires re-calibration from time to time due to changes in the apparatus' behavior, as might be affected by the state of processor chemicals if any are used, color marking system drifts, and changes in receiver characteristics. Differences in receiver characteristics might be caused by different recipes, variations in receivers from one coating event to another, and different surface finishes (i.e., glossy verses matte finishes) as are commonly encountered using photographic receivers.

Calibration of a color reproduction apparatus begins by specifying color aim curves. A color aim curves are a set of three or four separate curves, one for each of the red, green blue and possibly black channels and each specifies the desired density output as a function of the corresponding input code value. It is intended that the three (or four) separate curves are to be used in concert and is designed to sample the entire density range. It is commonplace that when the input code values for red, green and blue channels are equal, that a visually neutral gray is to be rendered. The color aim curve defines both the definition of neutral in terms of the relationship between measured densities and the relation between (common) input code values and output densities. The entries of the table define a relationship of density as a function of input code value, or:

$$\text{Density} = f(\text{iCV})$$

It is further commonplace to develop three such functions for a 3-color printer, one for each color. Thus, the family of functions can be expressed as:

$$\text{Density}_{\text{Red}} = f_{\text{red}}(\text{iCV}_r),$$
$$\text{Density}_{\text{Green}} = f_{\text{green}}(\text{iCV}_g), \text{ and}$$
$$\text{Density}_{\text{Blue}} = f_{\text{blue}}(\text{iCV}_b).$$

These equations are used to find the correct drive code values for each entry in the three calibration lookup tables.

Often, aim curves are linear. A truly neutral density (gray) calibration target (FIG. 1) contains a series of aim neutral (gray) density patches, which are encoded as grays ranging from white to black. The input code values in the target's description are passed through existing calibration lookup tables to re-map them into drive code values that the reproduction apparatus will actually use to make a print. If the reproduction apparatus is in calibration, the resultant print will have the correct aim densities. Mathematical transforms may be employed in lieu of lookup tables. The resulting densities of the rendered patches are measured using an optical instrument such as a densitometer; and compared to the aim densities. If any of the patch density values are different than aim, being either too light or dark, or possess a non-neutral hue, then new sets of calibration lookup

table values or transforms are derived using a mathematical method such as regression so as to increase or decrease the density of the corresponding color.

The limitation in this process is that the red density is not just a function of the cyan drive code value. Rather, it is a function of the drive code values of all the other colors. Albeit, the red density has a strong dependency on the cyan drive code value and a weaker dependency on the other drive code values. This being the case, if one adjusts, say, the magenta drive code value to make a correction to the green density, then the red density will change even though the cyan code values do not change. Similarly, changes to the cyan code values will produce changes to the green and blue densities. Although this known calibration process usually works because the cross-dependencies are small, it is often necessary to conduct a series of successive calibrations, each using the previous output lookup tables, in order to achieve a final calibration within specification.

## DISCLOSURE OF THE INVENTION

It is an object of the present invention to provide for calibration of color reproduction apparatus by analyzing the densities read off of a calibration target rendered on the reproduction apparatus and by computing a new calibration lookup table for bringing the color reproduction apparatus into calibration such that the desired behavior of the reproduction apparatus when it is in calibration is described by an aim curve which specifies the desired density output as a function of drive code values.

It is another object of the present invention to provide for calibration of color reproduction apparatus by analyzing the densities read off of a calibration target rendered on the reproduction apparatus and by computing a new calibration lookup table or equivalent thereof for bringing the color reproduction apparatus into calibration such that the desired behavior of the reproduction apparatus when it is in calibration is described by an aim curve which specifies the desired density output as a function of drive code values in a single pass.

The present invention involves the rendering of a target containing not only neutral density patches but also a sampling of intentional off-neutral patches, produced by selecting sets of red, green, and blue (and sometimes black) input code values for those patches which deviate from sets of values that would produce neutral densities, and then, by analyzing how the measured densities of all the patches change with changes in code values, determining the optimum set or sets of the three (or four) input code values that when used together produce a desired set of aim neutral density patches in a single iteration.

According to a feature of the present invention, calibration is effected by using the color reproduction apparatus to produce a calibration target having a plurality of color patches by using input code values which correspond to a sampling of color densities. One subset of the color patches is intended to have neutral color density values and another subset of the color patches is intended to have non-neutral color density values deviating in their mix of red, green, and blue from each other. The color densities of the color patches produced on the calibration target are measured. Error signals characteristic of differences between measured color densities and intended color densities are produced. Finally, the converting process of said reproduction apparatus is adjusted as a function of the error signals so as to provide output color densities closer to the intended color densities.

The invention, and its objects and advantages, will become more apparent in the detailed description of the preferred embodiments presented below.

## BRIEF DESCRIPTION OF THE DRAWINGS

In the detailed description of the preferred embodiments of the invention presented below, reference is made to the accompanying drawings, in which:

FIG. 1 is a schematic diagram showing a near-neutral test pattern employed in the prior art;

FIG. 2 is a schematic diagram illustrating a color reproduction system according to the present invention;

FIG. 3 is a plot of measured density data from a target verses input code value plotted with the desired behavior;

FIG. 4 is a chart of patch code values; and

FIG. 5 is another chart of patch code values.

## DETAILED DESCRIPTION OF THE INVENTION

The present description will be directed in particular to elements forming part of, or cooperating more directly with, apparatus in accordance with the present invention. It is to be understood that elements not specifically shown or described may take various forms well known to those skilled in the art.

Referring to FIG. 2, a color image, represented in digital form as a plurality of image input code values $iCV_R$, $iCV_G$, $iCV_B$, corresponding respectively to desired densities $D_R$, $D_G$, and $D_B$, is inputted by a digital image processor 12. The image processor or the reproduction apparatus contains three separate calibration lookup tables (or channels) in a 3-color reproduction apparatus (one lookup table for each color red, green and blue) for converting received digital input code values $iCV_R$, $iCV_G$, $iCV_B$ into uniquely-associated drive code values $dCV_R$, $dCV_G$, and $dCV_B$, respectively, for a reproduction apparatus 14. The image processor or the reproduction apparatus may contain four lookup tables or channels for a 4-color reproduction apparatus (black and the other three colors). Mathematical transforms may be employed in lieu of lookup tables. Reproduction apparatus 14 uses the code values to produce color separations for the final rendering.

Calibration of the color reproduction apparatus begins by specifying one or more aim curves of the desired density output as a function of input code values for the entire density range. In FIG 3, the diagonal line represents the desired behavior of the system for one possible aim curve description whereby input code values are linearly related to desired output densities. A calibration target containing a series of both neutral and non-neutral aim color density patches is digitized into a series of density signals and passed through image processor 12 to remap the image's input code value signals into

drive code values used by reproduction apparatus 14 to make a rendering. The resulting densities of the rendered patches are measured using an optical instrument such as a densitometer 18; and compared to the intended color densities. In FIG. 3, the data points are the actual measured densities from the target plotted against the target input code values. If, as in FIG. 3, any of the patch density values are different than intended, being either too light or dark, or possess a non-neutral hue, then, using a mathematical method such as regression, new sets of lookup table values or transforms are derived so as to increase or decrease the density of the corresponding color.

The present invention, recognizes that in the calibration processes, each color density is not just a function of the drive code value for that color, but rather, it is a function of the drive code values of all the other colors. For example, color reproduction apparatus adapted to expose color silver halide paper with red, green, and blue light will experience dye sensitivity crosstalk wherein the behavior of each color emulsion layer of the receiver is not independent of the exposure of the other layers. That is, green light will not only expose the green sensitive emulsion layer, but will have some effect on the red and blue sensitive emulsion layers as there are overlaps in sensitivity. Accordingly, changing the drive code values for one color will result in small effective changes in the other color channels.

Rather than rendering only patches having neutral code values, the present invention provides for producing a series of additional patches that vary the red, green and blue input code values somewhat from neutral values. For example, one might render one patch with neutral input code values, another patch in which the red input code value is increased slightly, still another patch in which the green input code value is increased, and yet another patch in which the blue input code value is increased. In this way, one not only can determine if, and by how much the neutral patches differ from neutral, but also how much the densities change for known changes in the individual drive code values which are

determined by passing the known input code values through the calibration look up tables.

There are a number of mathematical paradigms for using this information. In a very simple example, a certain neutral aim color should be achieved with drive code values of, say, 100, 100, and 100. If one renders three patches shown in FIG. 4, one with drive code values 104, 99, and 99; the second with drive code values 99, 104, 99; and the third with drive code values 99, 99, and 104, and if in the domains 99 to 104 the behavior is assumed to be linear, relations between drive code values and resulting densities can be written as:

$$D_r = a*dCV_r + b*dCV_g + c*dCV_b,$$

$$D_g = e*dCV_r + f*dCV_g + g*dCV_b, \text{ and}$$

$$D_r = i*dCV_r + j*dCV_g + k*dCv_b.$$

Since there are three sets of drive code values and three sets of resulting density points, ($D_r$, $D_g$, $D_r$), there are nine equations and nine unknowns. This is a classical Matrix Algebra problem with known, published solutions. Once the nine coefficients are determined, the equations can then be used to solve for the unique set of $dCV_r$, $dCV_g$, $dCV_b$ of drive code values that produce the set of aim neutral densities, $D_r$, $D_g$, $D_b$. Given the information set forth above, numerous schemes using different numbers of variation patches and improved accuracy can be thought of by those skilled in the art. The minimum number of patches is three.

There would be two problems with the very simple example described above. One problem is that, depending on how the three sets of patches are chosen, one may never produce a neutral patch so one never can be sure that the neutral is in fact achieved. The second problem is that the functional behavior must be not only linear, but the function must pass through the origin. A simple solution to both problems in the above scheme is to add the neutral patch (100, 100, 100) as shown in FIG. 5, and to add an offset to the equations, such that:

$$D_r = C_r + a*dCV_r + b*dCV_g + c*dCV_b,$$

$$D_g = C_g + e*dCV_r + f*dCV_g + g*dCV_b, \text{ and}$$

$$D_b = C_b + i*dCV_r + j*dCV_g + k*dCv_b.$$

Adding yet another point (total of 5 patches) would allow a quadratic term in the most sensitive channel. Equations might look like:

$$D_r = C_r + a*dCV_r + b*dCV_g + c*dCV_b + p_r*dCV_r^2,$$
$$D_g = C_g + e*dCV_r + f*dCV_g + g*dCV_b + p_g*dCV_g^2,$$
$$D_b = C_b + i*dCV_r + j*dCV_g + k*dCV_b + p_b*CV_b^2.$$

Adding additional patches would allow additional degrees of freedom to the equations and/or regression analysis to reduce the effect of noise.

The collection, called "cluster," of patches including the neutral patch and the deviated patches is hereafter referred to as a "ring-around." The target will have a group of clusters of patches, including the neutral patch and the deviated patches. Each cluster is used to produce one triad of red, green and blue drive code values that, when used together produce one neutral density patch. The ultimate objective is that each group of clustered patches is used to find a single triad of red, green and blue drive code values that produce a single aim neutral. Then combining all such solutions for all the clusters of patches on the target perform separate curvefits on the density vs. code value solutions for each of the color channels as if they were independent:

$$D_r = f_{red}(dCV_r),$$
$$D_g = f_{green}(dCV_g),$$
$$D_b = f_{blue}(dCV_b),$$

with the understanding that these equations are valid only when used together and the collective solutions produce a triad of densities that correspond to an aim neutral. This set of functions can be called the neutral characteristic curves of the rendering device because they describe its native behavior when producing neutral colors.

These 3 curvefit functions are then combined with the three aim curves to produce new calibration look up tables as follows. The aim curves map neutral input code values to sets of densities producing neutral. The neutral characteristic curves map the drive code values to densities producing neutral.

Thus a new mapping between input code values and output code values can be determined using the neutral densities as the common link. It is to be understood that all of the steps described above are preferably performed automatically in a digital image processor, with the possible exception of manually transferring rendered test patches from the reproduction apparatus to a scanner.

According to one preferred embodiment of the present invention, a set of, say, one to two dozen neutral points are selected along the neutral axis (i.e., the locus of neutral sets-of-densities) in a three-dimensional density space whose axes corresponding to the red, green and blue densities. For each neutral point, four non-neutral points are selected such that the four non-neutral points sit on a common plane wherein (1) the neutral axis is normal to the common plane, (2) the common plane is further out (darker) on the neutral axis than the corresponding neutral point, (3) the four non-neutral points represent the corners of a square in the common plane such that the square is centered on the point where the neutral axis cuts the common plane, and (4) all four non-neutral points are roughly equidistant from each other.

The invention has been described in detail with particular reference to preferred embodiments thereof, but it will be understood that variations and modifications can be effected within the spirit and scope of the invention.

**WHAT IS CLAIMED IS:**

**1.** A method of calibrating a color reproduction apparatus which has a process for converting received digital color signals to uniquely-associated drive code values and to then produce an image rendering with color densities corresponding to the drive code values; the method comprising the steps of:

using the color reproduction apparatus to produce a calibration target having a plurality of color patches by using input code values which correspond to a sampling of color densities, wherein one subset of said color patches is intended to have neutral color density values and another subset of said color patches is intended to have non-neutral color density values deviating in their mix of red, green, and blue from each other;

measuring color densities of the color patches produced on said calibration target;

producing error signals characteristic of differences between measured color densities and intended color densities; and

adjusting the converting process of said reproduction apparatus as a function of said error signals so as to provide output color densities closer to the intended color densities.

**2.** A method according to claim 1, wherein said adjusting step comprises the step of determining a relationship between said color patches by performing data interpolation from at least three of said patches, wherein said at least three patches represent a sampling of red, green, blue and black color codes.

**3.** A method according to claim 1, wherein said one subset of color patches is a set of neutral density patches.

**4.** A method according to claim 1, wherein said step of producing error signals comprises the step of determining target values of each of a red density, a green density, and a blue density as a function of a red drive code value, a green drive code value, and a blue drive code value.

5. A method according to claim 1, wherein said step of producing error signals comprises the step of determining target values of each of a red density, a green density and a blue density as a function of a red drive code value, a green drive code value, a blue drive code value and a black drive code value.

6. A method according to claim 1, wherein:

the patches of said one subset of color patches have neutral density code values; and

the patches of the another subset of color patches have red, green or blue density values which are deviated from the neutral density values.

7. A calibration target comprising media having at least one first patch with a neutral density code value, at least one second patch having a red code value which is deviated from its neutral value, at least one third patch having a green code value which is deviated from its neutral value, and at least one fourth patch having a blue code value which is deviated from its neutral value.

8. A calibration target as defined in Claim 7 wherein said at least one second, third, and fourth patch code values are selected by:

designating a set of neutral points along a neutral axis in a three-dimensional density space whose axes corresponding to red, green and blue densities; and

for each neutral point, selecting four non-neutral points such that the four non-neutral points sit on a common plane wherein (1) the neutral axis is normal to the common plane, (2) the common plane is further out on the neutral axis than the corresponding neutral point, (3) the four non-neutral points represent corners of a square in the common plane such that the square is centered on a point where the neutral axis intercepts the common plane, and (4) all four non-neutral points are roughly equidistant from each other.

9. A calibration target according to claim 7, comprising:

a plurality of said first patches such that said neutral density code values of each of said first patches is different from other first patches;

a plurality of said second patches such that said red input code values of each of said second patches is different from other second patches;

a plurality of said third patches such that said green input code values of each of said third patches is different from other third patches; and

a plurality of said fourth patches such that said blue input code values of each of said fourth patches is different from other fourth patches.

**10.** A calibration target according to claim 7, comprising:

a plurality of said first patches arranged in a first group, such that said neutral density code values of each of said first patches is different from other first patches;

a plurality of said second patches arranged in a second group, such that said red code values of each of said second patches is different from other second patches;

a plurality of said third patches arranged in a third group, such that said green code values of each of said third patches is different from other third patches; and

a plurality to said fourth patches arranged in a fourth group, such that said blue code values of each of said fourth patches is different from other fourth patches.

**11.** A calibration target according to claim 7, wherein the media comprises a single sheet upon which said least one first patch, said at least one second patch, said at least one third patch, and said at least one fourth patch are provided.

**12.** A calibration target according to claim 7, wherein the media comprises:

a first sheet upon which said at least one first patch is provided;

a second sheet upon which said at least one second patch is provided;

a third sheet upon which said at least one third patch is provided; and

a fourth sheet upon which said at least one fourth patch is provided.

## ABSTRACT OF THE DISCLOSURE

Reproduction apparatus calibration is effected by rendering not only neutral density target patches but also a sampling of intentional off-neutral patches produced by selecting sets of red, green, and blue (and sometimes black) input code values for those patches which deviate from sets of values that would produce neutral densities. Then, by analyzing how the measured densities of all the patches change with changes in code values, the optimum set or sets of the three (or four) input code values that when used together produce a desired set of aim neutral density patches in a single iteration are determined.

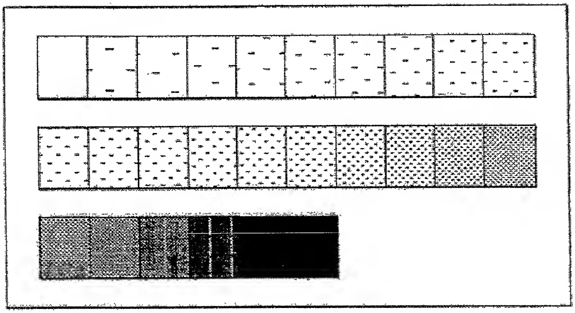


FIG.1

FIG. 2

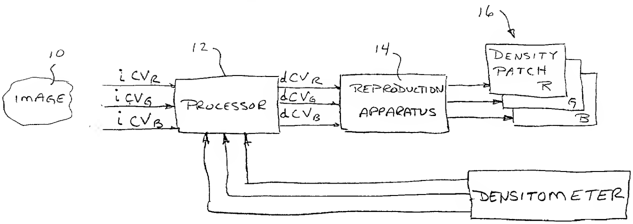
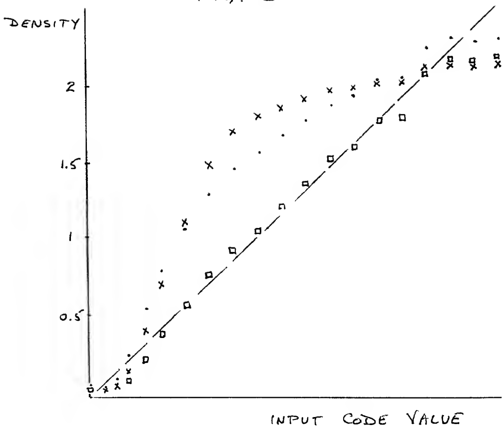

10
IMAGE
$i\,CV_R$
$i\,CV_G$
$i\,CV_B$
12
PROCESSOR
$dCV_R$
$dCV_G$
$dCV_B$
14
REPRODUCTION
APPARATUS
16
DENSITY
PATCH
R
G
B
DENSITOMETER

FIG. 3




| | R | G | B |
|---|---|---|---|
| PATCH 1 | 104 | 99 | 99 |
| PATCH 2 | 99 | 104 | 99 |
| PATCH 3 | 99 | 99 | 104 |

**FIG. 4**

| | R | G | B |
|---|---|---|---|
| PATCH 1 | 104 | 99 | 99 |
| PATCH 2 | 99 | 104 | 99 |
| PATCH 3 | 99 | 99 | 104 |
| PATCH 4 | 100 | 100 | 100 |

**FIG. 5**

| Combined Declaration For Patent Application and Power of Attorney | ATTORNEY DOCKET 79456MSS |
| --- | --- |

As below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below next to my name,

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled:

## CALIBRATION OF COLOR REPRODUCTION APPARATUS

The specification of which (check only one item below):

[X] is attached hereto.

[ ] was filed as United States Application Serial No. on and was amended on (if applicable).

[ ] was filed as PCT international application Number on and was amended under PCT Article 19 on (if applicable).

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose to the U.S. Patent & Trademark Office all information known to me to be material to patentability as defined in Title 37, Code of Federal Regulations, §1.56.

I hereby claim foreign priority benefits under Title 35, United States Code, §119 of any foreign application(s) for patent or inventor's certificate or of any PCT international application(s) designating at least one country other than the United States of America listed below and have also identified below any foreign applications(s) for patent or inventor's certificate or any PCT international application(s) designating a least one country other than the United States of America filed by me on the same subject matter having a filing date before that of the application(s) of which priority is claimed:

**PRIOR FOREIGN/PCT APPLICATION(S) AND ANY PRIORITY CLAIMS UNDER 35 U.S.C. 119:**

| COUNTRY (if PCT, indicate PCT) | APPLICATION NUMBER | DATE OF FILING (day month year) | PRIORITY CLAIMED UNDER 35 USC §119 | | | |
| --- | --- | --- | --- | --- | --- | --- |
| | | | | YES | | NO |
| | | | | YES | | NO |
| | | | | YES | | NO |

I hereby claim the benefit under Title 35, United States Code, 119 §(e) of any United States provisional application(s) listed below:

**PRIOR PROVISIONAL APPLICATION(S) AND ANY PRIORITY CLAIMS UNDER 35 U.S.C. §119 (e):**

| PROVISIONAL APPLICATION NUMBER | FILING DATE |
| --- | --- |
| | |
| | |

I hereby claim the benefit under Title 35, United States Code, §120 of any prior United States application(s) or PCT international application(s) designating the United States of America that is/are listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in that/those prior applications(s) in the manner provided by the first paragraph of Title 35, §112, I acknowledge the duty to disclose to the U.S. Patent & Trademark Office all information known to me to be material to patentability as defined in Title 37, Code of Federal Regulations §1.56, which became available between the filing date of the prior application(s) and the national or PCT international filing date of this application:

**PRIOR US APPLICATIONS OR PCT INTERNATIONAL APPLICATIONS DESIGNATING THE U.S FOR BENEFIT UNDER 35USC§120:**

| U.S. APPLICATIONS | | | STATUS (*Check one*) | | |
| --- | --- | --- | --- | --- | --- |
| U.S. APPLICATION NUMBER | U.S. FILING DATE | | PATENTED | PENDING | ABANDONED |
| | | | | | |
| | | | | | |
| PCT APPLICATIONS DESIGNATING THE U.S. | | | | | |
| PCT APPLICATION NO. | PCT FILING DATE | U.S. SERIAL NUMBERS ASSIGNED (*if any*) | | | |
| | | | | | |
| | | | | | |
| | | | | | |

| Combined Declaration For Patent Application and Power of Attorney *(Continued)* | ATTORNEY DOCKET 79456MSS |
|---|---|

**POWER OF ATTORNEY:** As a named inventor, I hereby appoint the following attorney(s) and/or agent(s) to prosecute this application and transact all business in the Patent and Trademark Office connected therewith *(List name and registration number)*

**Thomas H. Close, Registration No. 27,428**
**J. Lanny Tucker, Registration No. 27,678**
**Sarah Meeks Roberts, Registration No. 33,447**
**Milton S. Sales, Registration No. 24,516**

| Send Correspondence to: | Direct Telephone Calls to: *(name and telephone number)* |
|---|---|
| Milton S. Sales<br>Eastman Kodak Company<br>Patent Legal Staff<br>Rochester, NY 14650-2201 | Milton S. Sales<br>(716) 253-0127<br>FAX: (716) 726-9178 |

| | | | | |
|---|---|---|---|---|
| 2 | FULL NAME OF INVENTOR | FAMILY NAME Statt | FIRST GIVEN NAME David | SECOND GIVEN NAME J. |
| 0 | RESIDENCE & CITIZENSHIP | CITY Rochester | STATE OR FOREIGN COUNTRY New York 14624 | COUNTRY OF CITIZENSHIP USA |
| 1 | BUSINESS ADDRESS | BUSINESS ADDRESS Eastman Kodak Company | CITY 343 State Street, Rochester | STATE & ZIP CODE (COUNTRY) New York 14650 USA |
| 2 | FULL NAME OF INVENTOR | FAMILY NAME | FIRST GIVEN NAME | SECOND GIVEN NAME |
| 0 | RESIDENCE & CITIZENSHIP | CITY | STATE OR FOREIGN COUNTRY | COUNTRY OF CITIZENSHIP |
| 2 | BUSINESS ADDRESS | BUSINESS ADDRESS | CITY | STATE & ZIP CODE (COUNTRY) |
| 2 | FULL NAME OF INVENTOR | FAMILY NAME | FIRST GIVEN NAME | SECOND GIVEN NAME |
| 0 | RESIDENCE & CITIZENSHIP | CITY | STATE OR FOREIGN COUNTRY | COUNTRY OF CITIZENSHIP |
| 3 | BUSINESS ADDRESS | BUSINESS ADDRESS | CITY | STATE & ZIP CODE (COUNTRY) |
| 2 | FULL NAME OF INVENTOR | FAMILY NAME | FIRST GIVEN NAME | SECOND GIVEN NAME |
| 0 | RESIDENCE & CITIZENSHIP | CITY | STATE OR FOREIGN COUNTRY | COUNTRY OF CITIZENSHIP |
| 4 | BUSINESS ADDRESS | BUSINESS ADDRESS | CITY | STATE & ZIP CODE (COUNTRY) |
| 2 | FULL NAME OF INVENTOR | FAMILY NAME | FIRST GIVEN NAME | SECOND GIVEN NAME |
| 0 | RESIDENCE & CITIZENSHIP | CITY | STATE OR FOREIGN COUNTRY | COUNTRY OF CITIZENSHIP |
| 5 | BUSINESS ADDRESS | BUSINESS ADDRESS | CITY | STATE & ZIP CODE (COUNTRY) |
| 2 | FULL NAME OF INVENTOR | FAMILY NAME | FIRST GIVEN NAME | SECOND GIVEN NAME |
| 0 | RESIDENCE & CITIZENSHIP | CITY | STATE OR FOREIGN COUNTRY | COUNTRY OF CITIZENSHIP |
| 6 | BUSINESS ADDRESS | BUSINESS ADDRESS | CITY | STATE & ZIP CODE (COUNTRY) |

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application or any patent issuing thereon.

| | | |
|---|---|---|
| SIGNATURE OF INVENTOR 201<br>David Statt | SIGNATURE OF INVENTOR 202 | SIGNATURE OF INVENTOR 203 |
| DATE<br>3-8-2000 | DATE | DATE |
| SIGNATURE OF INVENTOR 204 | SIGNATURE OF INVENTOR 205 | SIGNATURE OF INVENTOR 206 |
| DATE | DATE | DATE |